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AN AUTOMATIC AËRATING DEVICE FOR AQUARIA

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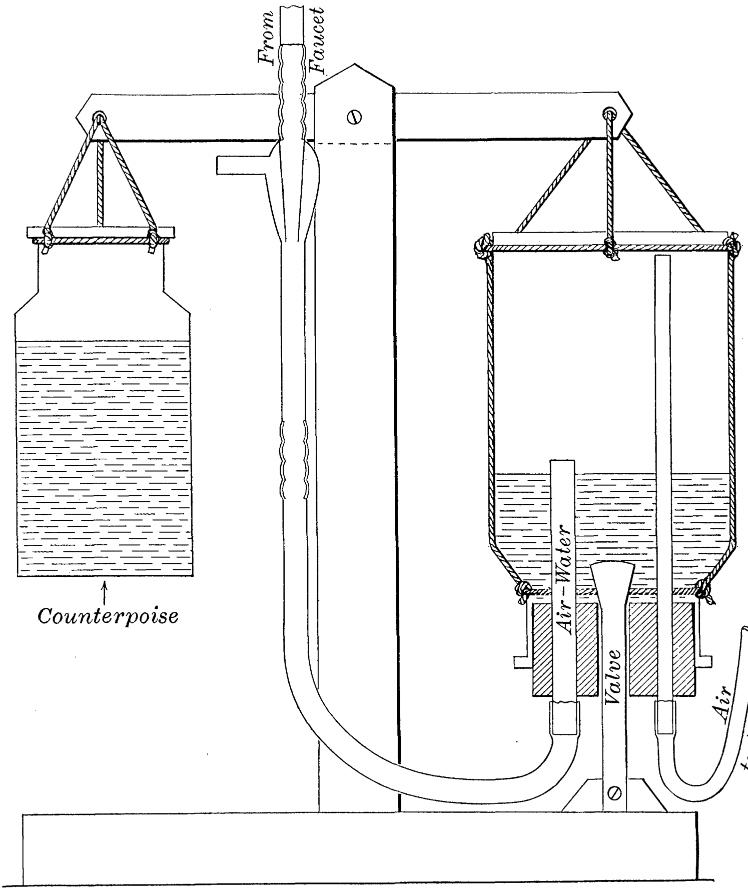
THE use of the water blast as a means of aërating is well enough known to need no more than passing mention. Its cost is prohibitive for smaller schools and its use limited to laboratories where noise would not be a disturbing factor. Furthermore it may be desirable to have an aquarium under observation in different rooms. Some time ago a simple device was described (*Amer. Nat.*, vol. 38, no. 453, 1904, pp. 655–661, 2 figs.) which, however, necessitates the exchange of the water in the aquarium. This might involve the loss of organisms if the flow were continuous as from a tap, or it would necessitate lifting the water periodically.

These were some of the difficulties I encountered when about a year ago I wished to aërate some small aquaria containing sea water, in a class room where fresh water was available, but a flow of sea water could not be had. An ordinary filter or vacuum pump was fitted into a calcium-chloride jar about 45 cm. tall. The accumulating air in the jar was carried through the stopper by a small tube to the aquarium. A ball valve of paraffin held against the lower opening of the jar by a lever and weight was to regulate the outflow of water. This and similar devices tried, failed to regulate the varying pressure in the supply pipes, and was not satisfactory. If regulated for the day when more taps were in use, the pressure increased during the night, with few or no other taps on, so that the fresh water overflowed through the air tube and diluted the sea water.

The above obstacles were entirely overcome in a device that I hit upon the past summer at the Marine Biological Laboratory

Woods Hole, in attempting to aërate the sea water in which Gonionemus was kept, rather than to use the water from the pipe. Other workers have carried water daily from the end of the pier to get more favorable results than with the water from the pipes. It remains to be seen whether aëration and cooling will answer these and other purposes. While I got very satisfactory results, yet my observations this season were not numerous enough to warrant any general claim for all-around usefulness.



A general idea of the apparatus may be gained from the figure. The things needed are a glass filter pump, two wide-mouth bottles, about 8 × 15 cm., and 6 × 12 cm., a cork stopper to fit the larger bottle, a stand with balance beam, glass and rubber tubing. The stopper is bored with three holes, 5 mm., 8 mm., and 11 mm. in diameter. Into the smaller holes are fitted a 24 cm. long tube for the air outflow and a 15 cm. long tube for carrying the water from the filter pump. The 11 mm. hole is for a wooden rod, 15 mm. in diameter and about 15 cm. long. This is cut down tapering abruptly from 15 mm. to 8 mm. the rest of its length. The larger end of this rod serves as a valve in the 11 mm. hole in the stopper being placed vertically so that the stopper can glide freely along the rod when placed in the inverted bottle.

A few details will be desirable for those who wish to try the apparatus. After inserting the glass tubes as shown in the figure, the wooden rod is inserted through the stopper from the side that goes into the bottle. Then the small end of the rod is attached to a block. Now the larger bottle is suspended in inverted position from one end of the balance beam of the stand, the stopper is inserted and the smaller bottle nearly filled with water is hung on the opposite end of the beam for counter-poise. The block carrying the wooden rod is moved about on the base of the stand until the stopper moves easily up and down the rod, and is then fastened in this position with a wood screw. The length of the cord supporting the inverted bottle should be so adjusted that the beam on this side is a little higher than on the opposite side when the stopper is drawn up against the head of the wooden rod as far as it will easily go. If the head of the rod fits the hole in the stopper accurately no water will escape when it is turned on until the weight of water in the inverted bottle exceeds that of the counterpoise. Now the weight of the counterpoise may be adjusted so that it will keep the larger bottle about $\frac{1}{3}$ full of water, thus preventing the escape of air except through the proper outlet. The water and air should not discharge alternately and if this does take place, a longitudinal groove may be cut into one side of the head in the stopper until enough water escapes to balance the inflow when the water pressure is at its lowest. From this on it will work automatically. Several other forms of valves may be used but I have found the one described the simplest.

If it is desired, more than one aquarium may be aërated with the same apparatus by dividing the air with T-tubes and using pinch cocks until the desired flow is obtained in each, necessitating, however, more attention than the simpler form. The main features of this apparatus are: its automaticity, its noiseless action making it suitable for the class room or laboratory table, its simplicity and inexpensiveness.

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